REMARKS/ARGUMENTS

This timely filed reply is responsive to the Final Office Action dated April 14, 2006 (Office Action) and is accompanied by a Request for Continued Examination (RCE) along with payment of the respective fees. A Rule 132 Declaration from Roddie R. Judkins, PhD (the "Judkins Declaration") accompanies this Reply. Dr. Judkins has substantial expertise in the field of gas hydrates and has authored numerous scientific publications. He is also the founder of the Interlaboratory Working Group on Methane Hydrates.

Claims 1-11 were pending at the time of the Office Action. All claims were rejected on the basis of 35 USC 103(a) in view of cited art. In this Reply, Claims 1, 10, and 11 have been amended. No new matter has been added.

The claims have been amended to more clearly point out an important aspect of novelty, viz., that Applicants' process fundamentally involves consolidation of the hydrate mixture as a substantially solid extruded body. This terminology is fully supported by information disclosed in the drawings as originally filed. Section 6 of the Judkins Declaration provides the following sworn evidence based on subject matter disclosed in the Application:

> "Although the word 'extrusion' does not appear in the specification as filed, the term is clearly supported by consideration of the drawings as filed. FIG. 1 clearly illustrates a lower spatial density of the individual hydrate particles when they are first forming, and a progressively higher packing density as the mixture travels along the tube, ultimately being discharged as a 'consolidated mass'. The tube wall clearly provides lateral restraint during this process. In my opinion, the term 'substantially solid extruded body' is a clear and accurate description of the product as shown in FIG. 1 and therefore does not represent new matter. Furthermore, FIGS. 2 and 3 present actual

photographs of the process, where, again, it is clear that the process is fundamentally an extrusion process."

Regarding Examiner's contention that "there is no basis in the art to distinguish one hydrate from another on the basis of 'consolidation'", according to the Examiner:

> Finally, claim 1 requires that a "consolidated solid-like hydrate/fluid/water" stream is formed. Iijima does not use the same language to describe the product that it delivers to the bottom of the ocean. However, the product of Iijima has negative buoyancy, as evinced by its description of the hydrate as something that will sink to the bottom of the ocean (see abstract, lines 5-6). The product of the present invention also possess negative buoyancy (see specification page 10, lines 1-2). This demonstrates that the product of Iijima meets the limitation of a "consolidated solid-like hydrate/fluid/water" stream being formed. Further, the process of Iijima in view of Max is the same as that claimed in the present invention. Therefore, the Iijima in view of Max process will form the same "consolidated solid-like hydrate/fluid/water" stream product.
>
> Finally, claim 1 requires that a "consolidated solid-like hydrate/fluid/water" stream is formed. Spencer does not use the same language to describe the product that it delivers to the bottom of the ocean. However, the product of Spencer has negative buoyancy, as evinced by its description of the hydrate as something that will sink to the bottom of the ocean (see column 2, lines 6-13). The product of the present invention also possess negative buoyancy (see specification page 10, lines 1-2). This demonstrates that the product of Spencer meets the limitation of a "consolidated solid-like hydrate/fluid/water" stream being formed. Further, the process of Spencer in view of Max is the same as that claimed in the present invention. Therefore, the Spencer in view of Max process will form the same "consolidated solid-like hydrate/fluid/water" stream product.

As to applicant's argument that Iijima produces "only less-consolidated CO_2-hydrate-water forms," no standard of consolidation is taught in the present specification. Further, there is no basis in the art to distinguish one hydrate from another on the basis of "consolidation".

Section 9 of the Judkins Declaration provides the following sworn evidence regarding distinguishing different states of consolidation:

> "I note first of all that buoyancy *per se* does not prove whether or not a particular product is solid. Many liquids are known that are immiscible in water and have greater density than that of seawater; droplets of such liquids would therefore have negative buoyancy and would sink in the ocean. Ice, on the other hand, is solid and yet has positive buoyancy.
>
> "Granted, however, that the products of some of the cited art are, strictly speaking, solid particles or granules, the key difference lies in the issue of consolidation. The issues are best understood by analogy: individual snowflakes and snowballs are both, in a fundamental sense, 'solids' and both are denser than air. At the same time, however, they are palpably different materials in many obvious ways. The individual snowflake has many times greater ratio of surface area to mass; it will melt immediately if placed into water that is above its freezing point. The snowball, by contrast, will remain solid much longer even under conditions where it would not be stable indefinitely. Such greater persistence under metastable conditions gives Applicants' extruded mass a greater leeway to survive and sink in the ocean than the granular particles made by the cited art. The cited art processes discharge a "stream" or slurry of individual solid particles freely dispersed in seawater and do not yield a consolidated extrusion able to retain integrity as a solid body as Applicants' process does."

Independent claims 1 and 11 have been amended to clarify that Applicants' consolidation process yields a substantially solid extruded body. Dependent claim 10

has been amended to provide claim language that has proper antecedent basis in independent claim 1.

Regarding claims rejections based on cited art, according to the Examiner:

103 Rejection over Iijima in view of Max

103 Rejection over Iijima in view of Ohsol

103 Rejection over Iijima in view of Satek

103 Rejection over Iijima in view of Allen

Claims 1, 2, 4, 6, 9-10 stand rejected under 35 USC 103(a) as being unpatentable over USP 5,364,611 to Iijima in view of USP 6,531,034 to Max.

The process of Iijima is the same as that of the present invention, with the exception that Iijima does not disclose turbulent flow. Iijima is directed to a process for forming a hydrate to be sunk in the ocean. As such, it would be desirable to produce as much hydrate as possible in the Iijima process. In light of the teaching of Max, turbulent flow conditions in the Iijima process would ensure adequate hydrate formation. Therefore, it would be obvious to run the Iijiima process under turbulent conditions, which would then be the same process as that claimed and as such the "consolidated solid-like hydrate/fluid/water stream" would be formed.

Claim 7 is rejected under 35 USC 103(a) as being unpatentable over Iijima '611 taken with Max '034 as applied to claims 1 and 4 above, and further in view of USP 5,426,137 to Allen.

As to claim 7, Iijima '611 does not disclose a jet pump to control the water flow. However, Allen '137 does disclose the use of a jet pump in a similar method. It would have been obvious to one of ordinary skill in the art at the time of this invention to use the jet pump of Allen '137 in place of the regular pump of Iijima '611 in order to provide for additional mixing. As discussed in Allen '137, a jet pump "contributes to the mixing of water with the mixture because of the high energy at which the jet pump injects water into the mixture (see col. 14, lines 50-53).

Claim 5 is rejected under 35 USC 103(a) as being unpatentable over Iijima '611 taken with Max '034 as applied to claims 1 and 4 above, and further in view of USP 4,913,886 to Satek.

As to claim 5, Iijima '611 does not disclose the use of a mass flow controller to control the flow of carbon dioxide. Satek '886 does use a mass flow controller to control the flow of the feed mixture (see column 15, lines 1-2). It would have been obvious to one of ordinary skill in the art at the time of this invention to add the mass flow controller of Satek '866 to the Iijima in view of Max method in order to more precisely control the flow rate to the process for better overall quality.

Claims 3 and 8 are rejected under 35 USC 103(a) as being unpatentable over Iijima '611 taken with Max '034 as applied to claims 1 and 4 above, and further in view of USP 5,738,762 to Ohsol.

As to claims 3 and 8, Iijima '611 does provide for adequate mixing of the carbon dioxide and the water, although the reference does not disclose the use of baffles. However, Ohsol '762 does use baffles for mixing in its process (see column 4, lines 39-43). It would have been obvious to one of ordinary skill in the art at the time of this invention to use baffles in order to adequately mix the carbon dioxide and the water, while minimizing system complexity.

In response, Applicants have amended independent claims 1 and 11 to clarify that the invention forms solid hydrate particles while providing sufficient lateral restraint to consolidate the particles into a substantially monolithic extruded body. This clearly involves a unique feature not found in or suggested by the cited art.

Section 10 of the Judkins Declaration provides the following sworn evidence relating to the art taught by Iijima in view of Max, Ohsol, Allen, and Satek:

> "In the photographs shown in FIGS. 2 and 3, a substantially monolithic extruded product is clearly being formed. It clearly has negative buoyancy as indicated by the fact that a length of the extruded material can be seen bending as the free length sags under the force of gravity. At the same time,

it clearly has sufficient mechanical integrity to withstand significant deformation. By contrast, the teachings of the cited art are clearly directed to the production of substantially granular or particulate hydrate forms:

"Iijima et al. '611 discloses several modes of making gas hydrates, all of which produce a substantially granular or particulate product. FIG. 7 shows solid hydrate being formed on the walls of a pipe, with a rotating screw blade to scrape the solid material off the walls as described at Col. 10 lines 49-55. FIG. 8 shows an arrangement that does not have the rotating screw but is still shown as discharging isolated particles or flakes. Likewise, FIGS. 10 and 11 show other configurations in which the solid hydrate phase is depicted as isolated particles rather than a compacted body. The discussion of FIG. 11 at Col. 12 lines 15-18 specifically refers to 'dispersing the product carbon dioxide hydrate out of the device'. **Dispersing** particles is essentially the opposite of Applicants' **consolidation** process.

"Max '034 contemplates the formation of individual hydrate particulates (referred to as 'crystals' at Col. 2 line 20 and elsewhere). Because Max intends for the hydrate to form in one stage of the process and decompose in another stage of the process, consolidating the hydrate into a monolithic extruded body would work against Max's goals. Max also refers to the 'hydrate slurry' (Col. 8 line 31 and elsewhere) which clearly refers to a suspension of individual particles in a fluid; this is also shown in FIG. 8 of Max where the hydrate phase is shown as individual particles that are freely dispersed in the flowing water and are not compacted into a monolithic body. The slurry of Max would clearly not have the mechanical properties shown by Applicants' material in Applicants' FIG. 3 as filed.

"Ohsol '762 teaches the use of mixing baffles in a completely different process. Satek '886 teaches the use of a mass flow controller in a completely different process. Allen '137 teaches the use of a jet pump for mixing fluids. Because neither Spencer '891, nor Iijima '611, nor Max '034 teach Applicants'

use of lateral constraint and consolidation of the hydrate stream into a monolithic body, adding any or all of the teachings of Ohsol, Satek, or Allen will not produce Applicants' process and result, nor is there anything in the teachings of Spencer, Iijima, or Max to suggest that it would."

For the reasons given above, allowance of presently amended claim 1 is respectfully requested.

Regarding claims 2, 3, 4, 5, 6, 7, 8, 9, and 10 applicants submit that these claims are dependent on presently amended claim 1, a claim now deemed patentable and, as a result, previously presented claims 2-10 now have independently patentable limitations. Accordingly, allowance of claims 2-10 is respectfully requested.

103 Rejection over Spencer in view of Max

103 Rejection over Spencer in view of Ohsol

103 Rejection over Spencer in view of Satek

103 Rejection over Spencer in view of Allen

Claims 1, 2, 4, 6, 9-10 stand rejected under 35 USC 103(a) as being unpatentable over USP 5,562,891 to Spencer in view of USP 6,531,034 to Max.

Finally, claim 1 requires that a "consolidated solid-like hydrate/fluid/water" stream is formed. Spencer does not use the same language to describe the product that it delivers to the bottom of the ocean. However, the product of Spencer has negative buoyancy, as evinced by its description of the hydrate as something that will sink to the bottom of the ocean (see column 2, lines 6-13). The product of the present invention also possess negative buoyancy (see specification page 10, lines 1-2). This demonstrates that the product of Spencer meets the limitation of a "consolidated solid-like hydrate/fluid/water" stream being formed. Further, the process of Spencer in view of Max is the same as that claimed in the present invention. Therefore, the Spencer in view of Max process will form the same "consolidated solid-like hydrate/fluid/water" stream product.

The process of Spencer is the same as that of the present invention, with the exception that Spencer does not disclose turbulent flow. Spencer is directed to a process for forming a hydrate to be sunk in the ocean. As such, it would be desirable desires to produce as much hydrate as possible in the Spencer process. In light of the teaching of Max, turbulent flow conditions in the Spencer process would ensure adequate hydrate formation. Therefore, it would be obvious to run the Spencer process under turbulent conditions, which would then be the same process as that claimed and as such the "consolidated solid-like hydrate/fluid/water stream" would be formed.

Claim 7 is rejected under 35 USC 103(a) as being unpatentable over Spencer '891 taken with Max '034 as applied to claims 1 and 4 above, and further in view of USP 5,426,137 to Allen.

As to claim 7, Spencer '891 does not disclose a jet pump to control the water flow. However, Allen '137 does disclose the use of a jet pump in a similar method. It would have been obvious to one of ordinary skill in the art at the time of this invention to use the jet pump of Allen '137 in place of the regular pump of Spencer '891 in order to provide for additional mixing.

Claim 5 is rejected under 35 USC 103(a) as being unpatentable over Spencer '891 taken with Max '034 as applied to claims 1 and 4 above, and further in view of USP 4,913,886 to Satek.

As to claim 5, Spencer '891 does not disclose the use of a mass flow controller to control the flow of carbon dioxide. Satek '886 does use a mass flow controller to control the flow of the feed mixture (see column 15, lines 1-2). It would have been obvious to one of ordinary skill in the art at the time of this invention to add the mass flow controller of Satek '866 to the Spencer in view of Max method in order to more precisely control the flow rate to the process for better overall quality.

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As to claims 3 and 8, Spencer '891 does provide for adequate mixing of the carbon dioxide and the water, although the reference does not disclose the use of baffles. However, Ohsol '762 does use baffles for mixing in its process (see column 4, lines 39-43). It would have been obvious to one of ordinary skill in the art at the time of this invention to use static mixer blades in order to adequately mix the carbon dioxide and the water, while minimizing system complexity.

In response, Applicants have amended independent claims 1 and 11 to clarify that the invention forms solid hydrate particles while providing sufficient lateral restraint to consolidate the particles into a substantially monolithic extruded body. This clearly involves a unique feature not found in or suggested by the cited art.

Section 10 of the Judkins Declaration further provides the following sworn evidence relating to the art taught by Spencer in view of Max, Ohsol, Allen, and Satek:

> "Spencer et al. '891 discuss the formation of hydrates that are 'removed from the hydrate production chamber by conduit...' (Col. 6 lines 41-42) and specifically describe an operation in which the hydrates will be 'released as solids into the ocean ... or pumped as a 50:50 clathrate-water slurry...' This clearly implies the formation of dispersed solid particles rather than a compacted monolithic body.

"Max '034 contemplates the formation of individual hydrate particulates (referred to as "crystals" at Col. 2 line 20 and elsewhere). Because Max intends for the hydrate to form in one stage of the process and decompose in another stage of the process, consolidating the hydrate into a monolithic extruded body would work against Max's goals. Max also refers to the 'hydrate slurry' (Col. 8 line 31 and elsewhere) which clearly refers to a suspension of individual particles in a fluid; this is also shown in FIG. 8 of Max where the hydrate phase is shown as individual particles that are freely dispersed in the flowing water and are not compacted into a monolithic body. The slurry of Max would clearly not have the mechanical properties shown by Applicants' material in Applicants' FIG. 3 as filed.

"Ohsol '762 teaches the use of mixing baffles in a completely different process. Satek '886 teaches the use of a mass flow controller in a completely different process. Allen '137 teaches the use of a jet pump for mixing fluids. Because neither Spencer '891, nor Iijima '611, nor Max '034 teach Applicants' use of lateral constraint and consolidation of the hydrate stream into a monolithic body, adding any or all of the teachings of Ohsol, Satek, or Allen will not produce Applicants' process and result, nor is there anything in the teachings of Spencer, Iijima, or Max to suggest that it would."

For the reasons given above, allowance of presently amended claim 1 is respectfully requested.

Regarding claims 2, 3, 4, 5, 6, 7, 8, 9, and 10 applicants submit that these claims are dependent on presently amended claim 1, a claim now deemed patentable and, as a result, previously presented claims 2-10 now have independently patentable limitations. Accordingly, allowance of claims 2-10 is respectfully requested.

Applicants believe that all claims are now in condition for allowance. Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance.

Respectfully submitted,

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